



# The relationship between sleep problems and challenging behavior among children and adolescents with autism spectrum disorder



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## ABSTRACT

Prior research has indicated fairly consistently that sleep problems appear to worsen ASD core symptomatology. As such, the present study was conducted to examine whether or not sleep problems also exacerbate behavior problems commonly exhibited by children and adolescents with ASD in terms of total, internalizing, and externalizing challenging behavior. Results indicated that presence of sleep problems increased the ratings of challenging behavior across types, as hypothesized. Unexpectedly, degree of sleep problem (i.e., mild versus severe) only affected total and externalizing challenging behavior, whereas ratings of internalizing challenging behavior were not significantly different between mild and severe sleep problem groups. Clinical applications of findings, as well as future directions for additional research on the topic of sleep among individuals with ASD, are discussed.

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## 1. Introduction

Autism spectrum disorder (ASD), one of the most common neurodevelopmental disorders, is characterized by persistent deficits in social communication and interaction and the presence of restricted, repetitive patterns of behaviors (Fodstad, Matson, Hess, & Neal, 2009; Horovitz & Matson, 2010; Levy & Perry, 2011; Matson & Boisjoli, 2008; Matson, Dempsey, & Fodstad, 2009; Matson, Dempsey, LoVullo, & Wilkins, 2008; Matson, González, Wilkins, & Rivet, 2008; Matson & Wilkins, 2008b; Worley & Matson, 2012). In addition to core symptoms, individuals with ASD are frequently affected by associated problems such as feeding and sleep difficulties, comorbid symptoms, and challenging behaviors (Kozłowski, Matson, Belva, & Rieske, 2012; Matson, Matson, & Beighley, 2011; Simonoff, Pickles, Charman, Chandler, & Baird, 2008; Smith & Matson, 2010a, 2010b, 2010c; Turygin, Matson, Adams, & Belva, 2013). These issues are underscored by the high prevalence of the condition (Matson & Kozłowski, 2011).

Specifically, sleep difficulties are one of the most common associated problems in children with ASD (Cortesi, Giannotti, Ivanenko, & Johnson, 2010; Richdale, 2001). Children with ASD have been reported to have more sleep problems than children who are typically developing (Krakowiak, Goodlin-Jones, Hertz-Picciotto, Croen, & Hansen, 2012; Liu, Hubbard, Fabes, & Adam, 2006; Souders et al., 2009). The most commonly reported sleep difficulties among children with ASD include settling difficulties, decreased sleep efficiency, bedtime resistance, insomnia, night awakenings, nightmares, and daytime sleepiness (Krakowiak et al., 2012; Liu et al., 2006; Richdale, 1999). Additionally, some children with ASD cycle between

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periods of hypersomnia and drastically reduced hours of sleep (Giannotti, Cortesi, Cerquiglini, & Bernabei, 2006). The topic of sleep disturbance in this population, including causes, implications, and treatment options, continues to be an area of interest in the field.

Although engaging in challenging behaviors is not required for a diagnosis of ASD, children with ASD frequently exhibit such behavior (Matson, Dempsey, & Fodstad, 2009c; Matson, Rivet, Fodstad, Dempsey, & Boisjoli, 2009). Challenging behaviors include internalizing behaviors such as self-injurious behavior, unusual play with objects, and stereotypies, and externalizing behaviors such as aggression, tantrums, and property destruction (Horner, Carr, Strain, Todd, & Reed, 2002; Matson, Boisjoli, Rojahn, & Hess, 2009; Matson, Cooper, Malone, & Moskow, 2008; Matson, Mahan, Hess, Fodstad, & Neal, 2010; Symons, Sperry, Dropik, & Bodfish, 2005). Previous researchers have found that challenging behaviors are more common than once believed, with estimates suggesting that up to 94% of children with ASD exhibit at least one challenging behavior (Jang, Dixon, Tarbox, & Granpeesheh, 2011; Matson, Wilkins, & Macken, 2009). Identifying and treating such behaviors is crucial because they may interfere with educational opportunities (Carr, Taylor, & Robinson, 1991; Horner, Diemer, & Brazeau, 1992), social relationships (Matson, Neal, Fodstad, & Hess, 2010; Matson & Wilkins, 2007), and access to normal activities (Matson & Nebel-Schwalm, 2007), thus negatively affecting the overall quality of life of children with ASD and their families (Matson & Rivet, 2008). Furthermore, severe challenging behaviors may pose a threat to the safety of the individual and his or her family members or caregivers (Emerson, 2000; Holden & Gitlesen, 2006).

Abundant research evidence suggests the existence of a relationship between sleep problems and ASD symptoms. More specifically, researchers indicate that sleep problems exacerbate symptoms characteristic of autism (Adams, Matson, Cervantes, & Goldin, 2014; Kozłowski et al., 2012; Matson, Ancona, & Wilkins, 2008; Richdale & Schreck, 2009; Schreck, Mulick, & Smith, 2004), including increased communication and social deficits correlated with sleep problems (Matson, Ancona, et al., 2008; Richdale & Schreck, 2009; Schreck et al., 2004). Given the frequency and severity of both challenging behaviors and sleep difficulties in individuals with ASD, examining the relationship between these problems is imperative. Previously, studies examining this relationship have been conducted using samples of individuals with learning difficulties and intellectual disabilities (ID). For example, Wiggs and Stores (2007) examined sleep difficulties and challenging behaviors in children with severe learning difficulties. The authors found that children with sleep difficulties exhibited significantly more types of daytime challenging behaviors (e.g., irritability, lethargy, hyperactivity, and stereotypic behaviors). Richdale and colleagues (2000) found that sleep problems were significantly associated with the presence of challenging behaviors among children with ID. Similarly, Brylewski and Wiggs (2001) also reported that adults with ID with sleep problems evinced more daytime irritability, stereotypy, and hyperactivity compared to those who did not have sleep difficulties.

Furthermore, Matson, Ancona, and colleagues (2008) reported that adults with ASD who suffered from more severe sleep disturbance engaged in more aggressive behaviors than those with milder sleep problems, and those with more severe sleep problems had a higher frequency of challenging behaviors. However, little is known about this relationship in children with ASD. Should presence or increasing severity of sleep problems be associated with greater ratings of challenging behavior, early identification and treatment for such difficulties may improve quality of sleep and subsequently decrease challenging behaviors. Therefore, the purpose of the current study was to examine this relationship in children and adolescents with ASD.

## 2. Method

### 2.1. Participants

Children and adolescents included in the present study were selected from a pre-existing, continually updated database of individuals recruited from schools, outpatient clinics, parent advocacy groups, and family support groups in 16 states. Parent or caregiver informants completed the assessment battery used in the present study, the *Autism Spectrum Disorder Battery, Child Version* (ASD-C; Matson & González, 2007), as a portion of comprehensive evaluations completed by the research team. Only individuals with a recorded diagnosis of ASD were included. The study was approved by the Louisiana State University Institutional Review Board, and parent or caregiver informants provided informed consent before initiating participation.

Inclusion criteria required all participants to have valid data in terms of age, gender, item number 18 on the *Autism Spectrum Disorder-Comorbid-Child Version* (ASD-CC; Matson & González, 2007), and fewer than two omissions on the *Autism Spectrum Disorder-Behavior Problems for Children* (ASD-BPC; Matson & González, 2007). The resulting sample consisted of 311 children and adolescents. Participants were 2–18 years of age ( $M = 7.95$ ,  $SD = 3.60$ ). The sample was composed of 80.1% males and 19.9% females, of which 83.1% were Caucasian, 10.6% were African American, 3.1% were Hispanic, 3.1% were of other ethnicity. Demographic data for the overall sample is presented in Table 1.

Participants were further classified into sleep problem groups based upon reported severity of sleep disturbance on the ASD-DC. This is discussed further in Section 2.3.

### 2.2. Measures

#### 2.2.1. Autism spectrum disorder – child version (ASD-C, Matson & González, 2007)

The ASD-C is an assessment battery for the evaluation of children and adolescents 2–18 years of age. The measure is composed of three separate scales, consisting of a total of 97 items, that provide evaluation of diagnostic symptomatology of

**Table 1**

Demographic variables by sleep problem group.

Sleep problems	Gender (% male)	Age (years) Mean (SD)	Ethnicity (N)	Total challenging behavior Mean (SD)
Overall sample (N = 311)	80.1	7.95 (3.60)	Caucasian 212 AA 27 Hispanic 8 Other 8	7.68 (5.81)
No sleep problem (N = 144)	82.6	7.96 (3.48)	Caucasian 91 AA 13 Hispanic 2 Other 1	5.53 (4.76)
Mild sleep problem (N = 111)	79.3	8.16 (3.90)	Caucasian 77 AA 9 Hispanic 3 Other 5	8.43 (5.41)
Severe sleep problem (N = 56)	75.0	7.52 (3.33)	Caucasian 44 AA 5 Hispanic 3 Other 2	11.70 (6.58)

Note. Total challenging behavior as measured using the *Autism Spectrum Disorder – Behavior Problems for Children*; higher scores indicate greater ratings of challenging behavior.

ASD, frequently comorbid symptoms, and challenging behaviors commonly exhibited by children with ASD. Parents or caregivers provide ratings of their children compared to same age peers on a 3-point Likert scale, with “0” indicating no problem or impairment, “1” indicating mild problem or impairment, and “2” indicating severe problem or impairment. For each of the three scales, the summation of items determines a total score. Furthermore, each scale has its own established factor structure or cut-offs. The current study utilizes the second two scales of the measure, *ASD-CC* and *ASD-BPC*.

The *ASD-CC* includes 39 items to assess problems and symptoms of psychopathology that individuals with ASD commonly exhibit, such as temper outbursts, depressive symptoms, avoidant behaviors, conduct problems, repetitive behaviors, and over- and under-eating. [Matson and Wilkins \(2008c\)](#) reported inter-rater and test-retest reliability for the *ASD-CC* as fair ( $k = .46$  and  $k = .51$ , respectively), and internal consistency as excellent ( $\alpha = .91$ ). Additionally, the subscale scores of the *ASD-CC* have strong convergence with similar subscales of the *Behavior Assessment System for Children, Second Edition* (BASC, [Matson, LoVullo, Rivet, & Boisjoli, 2009](#); [Reynolds & Kamphaus, 2004](#)).

The third scale of the battery, the *ASD-BPC*, consists of 18 items and is designed to assess challenging behavior that is frequently exhibited by individuals with ASD, such as self-harm, elopement, aggression toward others, and property destruction. [Matson, González, and Rivet \(2008\)](#) reported inter-rater reliability for the *ASD-BPC* as fair ( $k = .49$ ), test-retest reliability as good ( $k = .64$ ), and internal consistency as excellent,  $\alpha = .90$ . A simple, two-factor structure was established, with items loading on either externalizing or internalizing dimensions of behavior ([Matson, González, & Rivet, 2008](#)).

### 2.3. Procedure

Because disordered sleep is not clearly defined, and thus does not have established criteria, researchers frequently create their own designations or manners of quantifying sleep problems ([Richdale & Schreck, 2009](#)). Measurement may employ cut off scores on a particular measure or self- or informant-report. In the present study, sleep problems were considered using one item on a scale that aims to detect psychopathology that frequently co-occurs with ASD. The item, number 18 on the *ASD-DC*, reads, “Has trouble sleeping.” As per Section 2, informants rate this item on a 3-point Likert scale that indicates whether the child or adolescent in question has no problems, mild problems, or severe problems related to each item. The use of a single item on a caregiver report measure has been utilized in past research as a reliable indicator of the presence of sleep disturbance; the single checklist item employed by [Malow and colleagues \(2006\)](#) was a significant predictor of results garnered from a polysomnograph, which is considered the gold standard in sleep measurement ([Richdale & Schreck, 2009](#)).

Per endorsements on item 18 of the *ASD-CC*, the sleep problems variable was divided into three categories: no sleep problems (rating of 0 on item 18), mild sleep problems (rating of 1 on item 18), and severe sleep problems (rating of 2 on item 18). Subsequently, the 311 participants were categorized into one of these three sleep categories based upon their caregiver-reported rating on item 18: no sleep problems ( $n = 144$ ), mild problem ( $n = 111$ ), and severe sleep problem ( $n = 56$ ). All of the items of the *ASD-BP* were summed to produce a new variable, Total Challenging Behavior. Additionally, per prior factor analysis ([Matson, González, & Rivet, 2008](#)), corresponding items were summed to produce two additional variables, Internalizing Challenging Behavior (e.g., mouthing or swallowing objects causing bodily harm, leaving the supervision of caregiver without permission) and Externalizing Challenging Behavior (e.g., aggression toward others, property destruction). All statistical analyses were conducted in SPSS.

**Table 2**  
Pairwise comparisons.

Sleep problems	Sleep problems	Mean difference	Std. Error	Sig.
<i>Total challenging behavior</i>				
No sleep problem	Mild sleep problem	−.59 <sup>a</sup>	.13	.000
	Severe sleep problem	−1.17 <sup>a</sup>	.17	.000
Mild sleep problem	Severe sleep problem	−.58 <sup>a</sup>	.17	.003
<i>Internalizing challenging behavior</i>				
No sleep problem	Mild sleep problem	−.45 <sup>a</sup>	.11	.000
	Severe sleep problem	−.80 <sup>a</sup>	.14	.000
Mild sleep problem	Severe sleep problem	−.35	.15	.06
<i>Externalizing challenging behavior</i>				
No sleep problem	Mild sleep problem	−.41 <sup>a</sup>	.13	.004
	Severe sleep problem	−.95 <sup>a</sup>	.16	.000
Mild sleep problem	Severe sleep problem	−.54 <sup>a</sup>	.16	.003

Note: Adjustment for multiple comparisons: Bonferroni.

<sup>a</sup> The mean difference is significant at .05.

### 3. Results

Prior to further statistical tests, analyses of demographic factors were conducted to determine if sleep problem groups differed significantly in terms of gender, ethnicity, or age. An a priori chi-square analysis of gender revealed no significant difference between groups,  $\chi^2(2) = 1.54$ ,  $p = .46$ . Similarly, an a priori chi-square analysis of ethnicity revealed no significant difference between groups,  $\chi^2(6) = 5.20$ ,  $p = .52$ . An a priori one-way ANOVA with sleep problem group as the IV and age as the DV indicated no significant differences between diagnostic groups,  $F(2, 308) = .59$ ,  $p = .56$ . Because none of the demographic variables were significantly different between sleep problem groups, no variables needed to be covaried in further analyses.

For all three dependent variables studied (i.e., Total Challenging Behavior, Internalizing Challenging Behavior, Externalizing Challenging Behavior), the scores for the No Sleep Problems group were not normally distributed, while the scores for the Mild and Severe Sleep Problems group were normally distributed. As such, square root transformations were applied for all groups for all dependent variables, so that scores reached or nearly approached normality (i.e., for Externalizing Challenging Behavior, the No Sleep Problems group's kurtosis =  $-1.29$ , standard error = .40). Transformed data was subsequently used for all reported analyses, excluding those of demographic factors and of raw scores, means, and standard deviations. For all three transformed dependent variable scores, there was homogeneity of variances, as assessed by

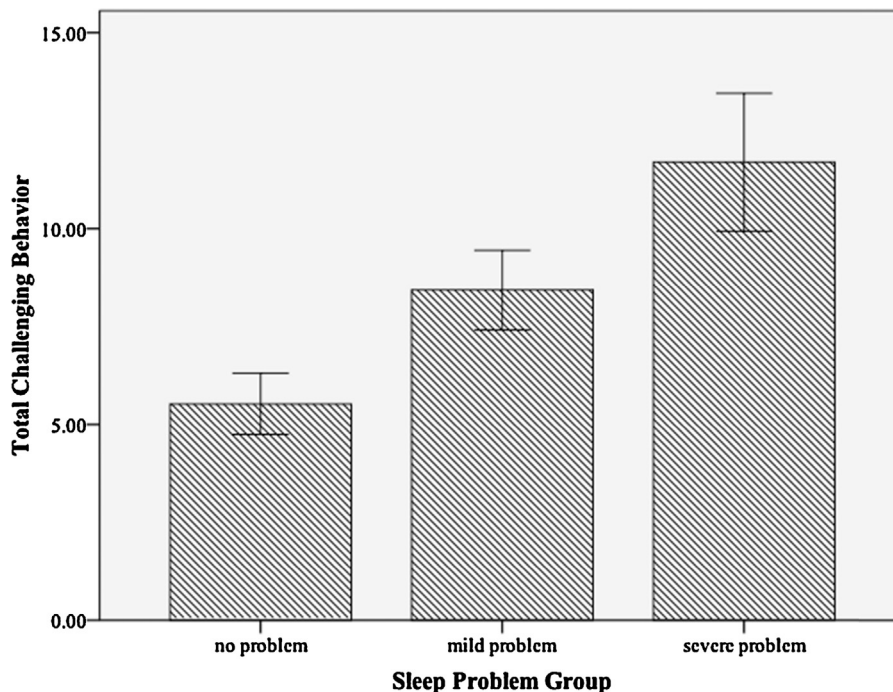


Fig. 1. Comparing total challenging behavior among sleep problem groups, with 95% confidence intervals.

Levene's Test of Homogeneity of Variance (Total Challenging Behavior,  $p = .80$ ; Internalizing Challenging Behavior,  $p = .60$ ; Externalizing Challenging Behavior,  $p = .83$ ).

Three separate ANOVAs were conducted with sleep problem group as the independent variable and challenging behavior (i.e., total, internalizing, externalizing) as the dependent variable. Total Challenging Behavior was statistically significantly different among different levels of sleep problems,  $F(2, 308) = 26.85$ ,  $p < .001$ . Additionally, Internalizing Challenging Behavior was statistically significantly different among different levels of sleep problems,  $F(2, 308) = 14.90$ ,  $p < .001$ . Finally, Externalizing Challenging Behavior was statistically significantly different among different levels of sleep problems,  $F(2, 308) = 18.74$ ,  $p < .001$ .

Following the preliminary ANOVAs, Bonferroni tests were used for post hoc multiple comparisons. For Total Challenging Behavior, the no sleep problem group had significantly lower scores than the mild sleep problem and severe sleep problem groups (mean difference =  $-.59$ ,  $p < .001$ ,  $d = -.57$ , and mean difference =  $-1.17$ ,  $p < .001$ ,  $d = -1.07$ , respectively). Additionally, the mild sleep problem group had significantly lower scores than the severe sleep problem group (mean difference =  $-.58$ ,  $p < .05$ ,  $d = -.54$ ). Similarly, for Internalizing Challenging Behavior, the no sleep problem group had significantly lower scores than the mild sleep problem and severe sleep problem groups (mean difference =  $-.45$ ,  $p < .001$ ,  $d = -.51$ , and mean difference =  $-.80$ ,  $p < .001$ ,  $d = -.84$  respectively). However, the mild sleep problem group did not have significantly different scores than the severe problem group (mean difference =  $-.35$ ,  $p = .056$ ,  $d = -.34$ ). For Externalizing Challenging Behavior, the no sleep problem group had significantly lower scores than the mild sleep problem and severe sleep problem groups (mean difference =  $-.41$ ,  $p < .05$ ,  $d = -.44$ , and mean difference =  $-.95$ ,  $p < .001$ ,  $d = -.97$ , respectively). Additionally, the mild sleep problem group had significantly lower scores than the severe sleep problem group (mean difference =  $-.54$ ,  $p < .05$ ,  $d = -.57$ ). These comparisons are presented in Table 2, and a visual representation of the comparisons is provided in Fig. 1.

#### 4. Discussion

Prior research has indicated fairly consistently that sleep problems appear to worsen ASD core symptomatology (Adams et al., 2014; Kozlowski et al., 2012; Matson, Ancona, et al., 2008; Matson & LoVullo, 2009; Richdale & Schreck, 2009; Schreck et al., 2004). As such, the present study was conducted to examine whether or not sleep problems also exacerbated challenging behavior commonly exhibited by individuals with ASD. Specifically, the authors analyzed total, internalizing, and externalizing challenging behavior.

As hypothesized, main effects of severity of sleep problem were found for total, internalizing, and externalizing challenging behavior. Post hoc tests confirmed that, in all categories of challenging behavior, the presence of sleep difficulties was associated with greater ratings of challenging behavior among children and adolescents with ASD. Unexpectedly, the groups representing degree of sleep problem (i.e., mild versus severe) did not differ significantly across all types of challenging behavior. Although increased severity of sleep problems were associated with increased ratings of challenging behavior for total and externalizing challenging behavior, there was no statistically significant difference between mild and severe sleep problem groups in terms of internalizing challenging behavior. Per these results, severity of sleep problem appears to have a greater effect on total and externalizing challenging behavior than it does on internalizing challenging behavior.

Much like with the relationship between sleep difficulties and ASD symptomatology, moderating and confounding variables should be considered in the relationship between sleep difficulties and challenging behavior among individuals with ASD. Any related factors that play a role in the relationship between sleep problems and ASD symptomatology are likely to affect frequency and severity of challenging behavior as well. Examples include co-occurring medical conditions (e.g., gastrointestinal problems, epilepsy), symptoms of comorbid disorders (e.g., anxiety), and/or use of medication. Identifying moderating and confounding factors should be a goal of future research regarding this topic, as such knowledge may inform etiology of sleep problems and have implications for current intervention options.

For the present study, prescription medication usage by participants was not taken into account, a limitation that should be addressed in future studies. At present, no medication has been identified that effectively manages the core characteristics of ASD (Cory et al., 2012; West, Waldrop, & Brunssen, 2009). Nonetheless, prescription of medication to individuals with ASD and related developmental disabilities is relatively common at present (Logan et al., 2012; Singh, Matson, Cooper, Dixon, & Sturmey, 2005). Administration of medication among this population generally aims to address commonly co-occurring problems (Cory et al., 2012), and moderate success has been observed in doing so (West et al., 2009). As such, managing maladaptive behavior is a primary purpose for the prescription of medication among this population (Benvenuto, Battan, Porfirio, & Curatolo, 2013; Canitano & Scandurra, 2011; Matson & Dempsey, 2008; Matson & Neal, 2009; Matson & Wilkins, 2008a). For example, risperidone, an antipsychotic medication, is frequently prescribed to individuals with ASD for this purpose (West et al., 2009). Fortunately, risperidone serves a dual role in decreasing disruptive behavior and difficulty falling asleep among individuals with ASD (Aman et al., 2005; Troost et al., 2005). However, some medications administered to decrease challenging behavior may actually increase sleep problems, including the onset of fatigue, insomnia, and/or sedation (Remington, Sloman, Konstantareas, Parker, & Gow, 2001; Stigler, 2014), producing an inverse relationship (i.e., as challenging behavior decreases due to medication treatment effects, sleep problems increase due to medication side effects). Additional long-term side effects, such as tardive dyskinesia, are common (Advokat, Mayville, & Matson, 2000; Matson & Mahan, 2010). As a result, identifying individuals using such medications would be crucial when studying the relationship between sleep and challenging behavior, as related confounding effects may alter results.



Findings of the present study have clear clinical implications. Based on the results, sleep problems, whether the mere presence of or the increasing severity of these issues, appear to increase challenging behavior. This finding is not surprising since environmental factors are known to affect this set of problems (Matson & Boisjoli, 2007; Matson & LoVullo, 2008; Matson et al., 2005; Matson & Minshawi, 2007). Challenging behavior among individuals with ASD is disruptive to the individual and his or her family or caregivers and decreases quality of life in numerous ways. If challenging behavior is severe enough to cause self-injury, harm to others, or property destruction, then a restrictive environment, such as in a long-term inpatient facility, may be necessary (Emerson, 2000). Should sleep problems be a source of exacerbation for severe challenging behavior, the treatment of such difficulties may be effective in initiating change. At present, interventions for sleep problems among individuals with ASD generally includes behavioral management strategies, such as extinction and scheduled awakenings (Vriend, Corkum, Moon, & Smith, 2011), and/or drug treatment, including the use of over-the-counter supplements like melatonin (Wright et al., 2011).

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